



## **Biological Stream Investigation**

**Release of Chicken Fat to an Unnamed Tributary of Little Beaver Creek,  
Phelps County, by Royal Canin USA, Inc.**

**April 8, 2005**

Prepared for:

Missouri Department of Natural Resources  
Water Protection and Soil Conservation Division  
Water Protection Program

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Appendix A – Maps  
Appendix B – Photographs  
Appendix C – Macroinvertebrate Bench Sheets

## **1.0 Introduction**

At the request of the Water Protection Program (WPP), the Environmental Services Program (ESP) conducted a biological investigation of an unnamed tributary to Little Beaver Creek in Phelps County, Missouri. The sampling was conducted on April 8, 2005 to provide data to the WPP for use in evaluating the aquatic community impact from a release of chicken fat from Royal Canin USA, Inc., a dog food manufacturing facility near Rolla, Missouri. Randy Sarver and Dave Michaelson of the Water Quality Monitoring Section (WQMS), Environmental Services Program, Air and Land Protection Division conducted the sampling. Members of the WQMS assisted in the analyses of the samples.

On April 4, 2005 Ron Sheeley of the Missouri Department of Natural Resources, Environmental Services Program responded to an environmental emergency at the farm of Mr. Archie Spencer. Mr. Spencer first witnessed the spill of chicken fat when he noticed a sick cow in his pasture. Mr. Spencer's pond and drainage above and below the pond had a covering of the yellow chicken fat on it. Mr. Sheeley investigated the release with the local fire department and haz-mat team. It was determined the release came from the Royal Canin Pet Food plant. It also appeared that this release might have been at least a week old. Mr. Sheeley did not notice any distressed or dead fish or other aquatic life. The release did enter an unnamed tributary to Little Beaver Creek, which ultimately enters Little Piney River approximately 4.5 miles downstream. Royal Canin was instructed to conduct a clean up, which was well underway when biological samples were collected.

## **2.0 Objective**

The objective of the study was to determine what impact, if any, the release of approximately 7000 pounds of liquid chicken fat from the Royal Canin facility had on the macroinvertebrate community of an unnamed tributary to Little Beaver Creek. Macroinvertebrate samples were collected immediately upstream and downstream of the point where the chicken fat entered the channel of the unnamed tributary to Little Beaver Creek. Primary metrics (MDNR 2003) were to be analyzed to determine if major differences existed between upstream and downstream station macroinvertebrate communities.

## **3.0 Study Area**

The unnamed tributary to Little Beaver Creek originates near the middle of Phelps County just inside the western limits of the city of Rolla. The reach of stream investigated is unclassified in the Missouri Water Quality Standards (MDNR 2000). Although the stream had flow during the time of the investigation, it is unknown whether groundwater contributions are of sufficient volume to provide permanent flow.

The unnamed tributary to Little Beaver Creek is located within the Ozark/Gasconade Ecological Drainage Unit (EDU). An EDU is a region in which biological communities and habitat conditions can be expected to be similar. Please see Appendix A for maps of the EDU and the local sampling locations. Table 1 compares the land cover percentages from the Ozark/Gasconade EDU and the 14-digit Hydrologic Unit (HU), # 10290203010004, that contains the sampling reach of the unnamed tributary. Land cover data were derived from Thematic Mapper satellite data from 1991-1993, and interpreted by the Missouri Resource Assessment Partnership (MoRAP).

Table 1  
Percent Land Cover

	Urban	Crops	Grassland	Forest
EDU	0.1	0.9	43.1	55.0
14-digit HU	0.2	0.0	32.6	66.6

#### 4.0 Site Descriptions

Station #1 (N ½ sec. 19, T. 35 N., R. 15 W.) was the downstream station on the unnamed tributary to Little Beaver Creek and was located downstream of the drainage that carried the chicken fat release from Royal Canin. Geographic coordinates of the downstream terminus of the sampling reach are Latitude 37.929011, Longitude -91.807847. Livestock did not have access to the stream.

Station #2 (N ½ sec. 31, T. 35 N., R. 15 W.) was the upstream station on the unnamed tributary to Little Beaver Creek and was located upstream of the drainage that carried the chicken fat release from Royal Canin. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.931436, Longitude -91.804989. Livestock did not have access to the stream.

#### 5.0 Methods

##### 5.1 Macroinvertebrates Collection

A standardized, single habitat, sample collection procedure for coarse substrate was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003). A single habitat macroinvertebrate collection, such as coarse substrate, is appropriate when water quality violations are investigated.

##### 5.2 Dissolved Oxygen Measurements

Dissolved oxygen was measured using a YSI Model 58 dissolved oxygen meter (MDNR property #95089). Dissolved oxygen measurements were taken in a manner consistent with the Standard Operating Procedure MDNR-FSS-103, Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter (MDNR 2002).

##### 5.3 Physical Sample Collection

Two discrete samples (sample #05-03176 & #05-03177) of the material (presumably chicken fat) were collected and frozen for physical evidence. The samples are currently stored in the WQMS biology laboratory freezer.

##### 5.4 Chain-of-Custody

All macroinvertebrate samples received a numbered label affixed to the sampling jar and an internal label after preservation with formalin. The corresponding label number was entered onto a chain-of-custody form indicating the date, time, and location of collection and parameters to be analyzed. The WQMS field personnel maintained custody of the samples for analyses. A chain of custody was completed in a manner consistent with MDNR-FSS-002, Field Sheet and Chain of Custody Record (MDNR 2001).

## 5.5 Macroinvertebrate Analyses

A standardized sample analysis procedure for coarse substrate samples was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003).

## 5.6 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003).

## 6.0 Observations

Stream stage appeared to be at base flow. There was no evidence of recent high water events. Congealed fat was observed in areas of the tributary downstream of the drainage leading from the Royal Canin facility and appeared recently released. Photographs documenting conditions at the time of this study are included as Appendix B. Available coarse substrate habitat in riffle/run sample areas of the downstream macroinvertebrate sample reach appeared to be substantially more abundant than in the upstream reach. Bedrock substrate was predominant at the upstream sampling location.

## 7.0 Results

### 7.1 Macroinvertebrates

Data were evaluated as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. The following four primary metrics were used in the evaluation: 1) Total Taxa (TT); 2) Ephemeroptera/Plecoptera/Trichoptera Taxa (EPTT); 3) Biotic Index (BI); and 4) Shannon Diversity Index (SDI). In addition, the Quantitative Similarity Index, a secondary metric, was calculated. Numeric biological criteria calculations for this investigation were determined to be inappropriate because of the small size of the unnamed tributary to Little Beaver Creek. Numeric biological criteria are only available for classified/wadeable streams at this time. The metric values for the unnamed tributary to Little Beaver Creek Stations #1 and #2 are listed in Table 2. Bench sheets for macroinvertebrate taxa are included as Appendix C.

Table 2  
Unnamed Tributary to Little Beaver Creek  
Coarse Substrate Sample Metrics - April 8, 2005

Sample #	05-03067	05-03066
Station	#1	#2
Taxa Richness	44	46
Ephemeroptera, Plecoptera, Trichoptera Taxa	13	13
Biotic Index	4.33	4.28
Shannon Diversity Index	2.75	2.97
Quantitative Similarity Index	62.3%	

## 7.2 Dissolved Oxygen

Dissolved oxygen values for the downstream sampling station are in Table 3.

Table 3  
Unnamed Tributary to Little Beaver Creek  
Dissolved Oxygen - April 8, 2005

Sample #	05-03176	05-03177
Station	#1	#1
Dissolved oxygen (mg/L)	13.7	13.7

## 8.0 Discussion

A biological investigation was performed to determine if a chicken fat release from Royal Canin had a substantial impact on the macroinvertebrate community of an unnamed tributary to Little Beaver Creek. There was no readily observable evidence of a major impact to the macroinvertebrate or fish community. However, despite our judgement that coarse substrate habitat appeared to be of better quality at the downstream station (potentially impacted), three of four primary metrics indicate that the downstream community was of slightly lower quality compared to the upstream community. The metrics that indicated a lower quality community were Taxa Richness, Biotic Index, and Shannon Diversity Index. The Ephemeroptera, Plecoptera, Trichoptera Taxa metric was the same at upstream and downstream stations. It was observed during invertebrate laboratory processing that many of the organisms from the downstream station were coated in fat. Since these organisms were observed after preservation, and post-mortem, it is possible that they were coated with fat after being placed in the sample jars. It is also possible that the invertebrates' external coating of chicken fat occurred instream. An external coating of fat could interfere with dissolved oxygen uptake by the gills and tracheae of aquatic invertebrates and could be responsible for a slight impact to the community and a decline in primary metrics. Additional information provided from the Quantitative Similarity Index (QSI) indicates that the macroinvertebrate community similarity was 62.3% between stations. Acceptable values for multi-habitat samples collected between reaches in the same reference stream range from 43%-63% QSI (Rabeni *et al.* 1999). Single habitat QSI values for reference streams were not published.

Dissolved oxygen was measured at the downstream sampling location and was well above the 5.0-mg/L criteria. However, this one-time measurement only indicates that four days after the initial response and after the majority of the clean-up, low dissolved oxygen was not below criteria.

As measured by the primary metrics, the biological stream investigation indicates a slightly lower quality macroinvertebrate community in the downstream reach of the unnamed tributary. The relative similarity of the upstream and downstream communities appears acceptable and does not indicate major impact. No evidence of dissolved oxygen impairment existed at the time of the investigation.

## **9.0 Literature Cited**

Missouri Department of Natural Resources. 2000. Title 10. Rules of Department of Natural Resources Division 20- Clean Water Commission, Chapter 7-Water Quality. 10 CSR 20-7.031 Water Quality Standards. Missouri Department of Natural Resources, Water Pollution Control Program, P.O. Box 176, Jefferson City, Missouri 65102. pp. 10-136.

Missouri Department of Natural Resources. 2001. Field Sheet and Chain of Custody Record. MDNR-FSS-002. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 8 pp.

Missouri Department of Natural Resources. 2002. Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter. MDNR-FSS-103. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 13 pp.

Missouri Department of Natural Resources. 2003. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 24 pp.

Rabeni, C.F., N. Wang, and R.J. Sarver. 1999. Evaluating adequacy of the representative stream reach used in invertebrate monitoring programs. *Journal of the North American Benthological Society* 18(2):284-291.

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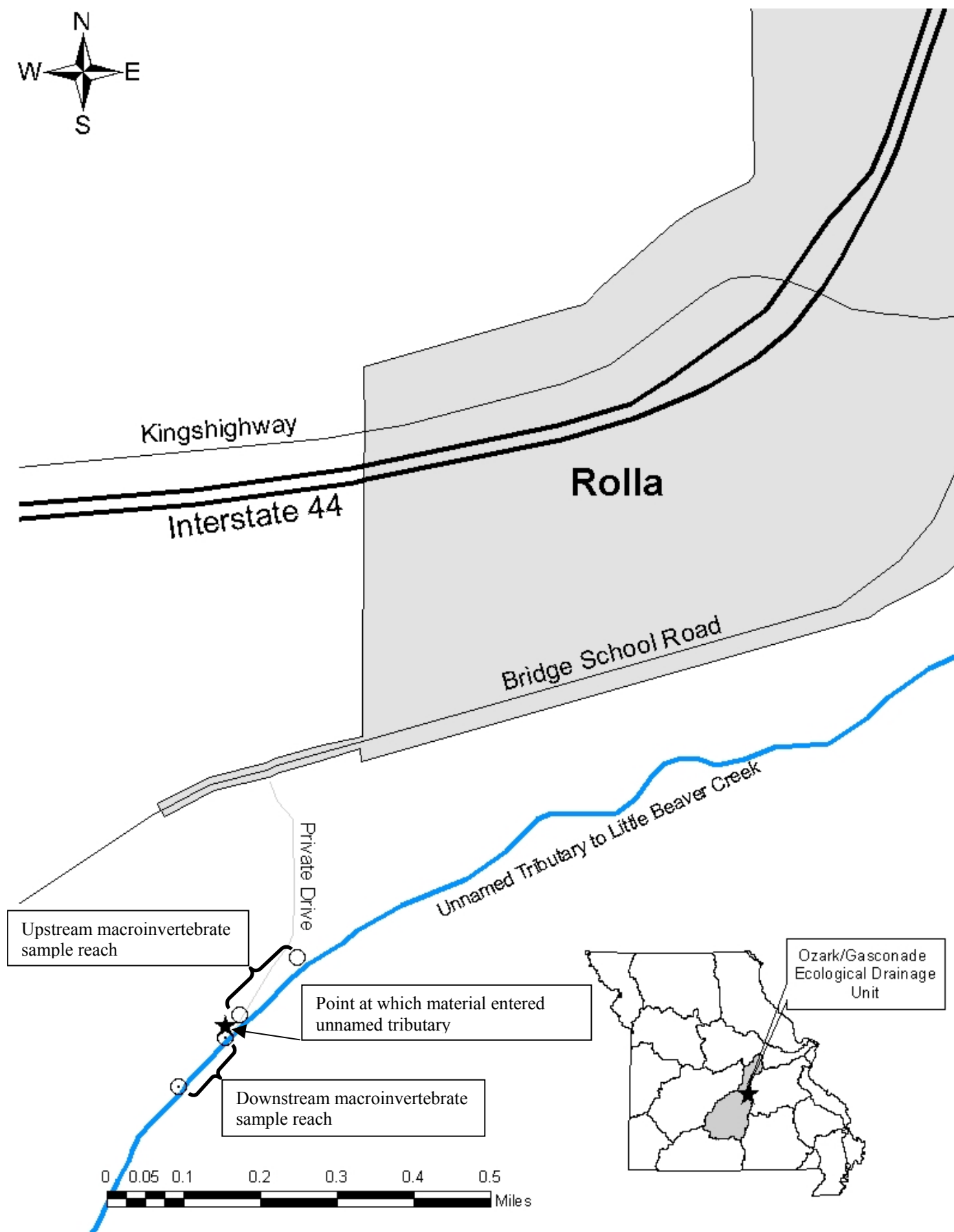
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Mike Potter, WPP

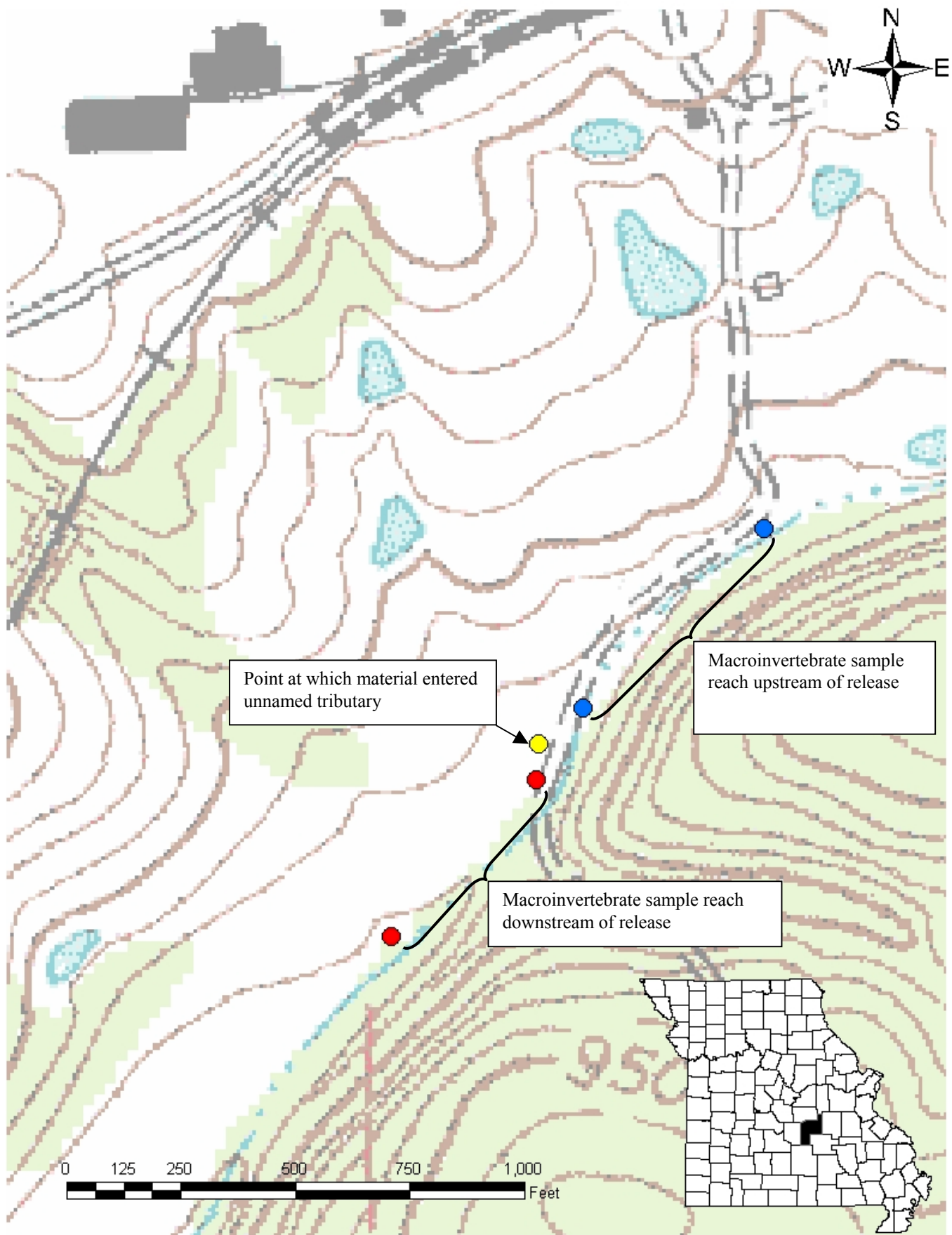


## **Appendix A**

### **Maps**

Unnamed Tributary to Little Beaver Creek, Sampling Locations &  
Ozark/Gasconade EDU





## **Appendix B**

### Photographs





Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
 Subject: Randy Sarver, MDNR-ESP, collecting water quality samples and dissolved oxygen readings at the intersection of the unnamed tributary and the ditch leading from the Royal Canin facility.      Photographer: Dave Michaelson



Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
 Subject: Photo of unnamed tributary near the intersection of waterway leading from the Royal Canin facility. Photo facing north toward facility (not visible in photo).  
 Photographer: Dave Michaelson





Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
 Subject: Randy Sarver, MDNR-ESP, collecting water quality samples and dissolved oxygen readings at the intersection of the unnamed tributary and the ditch leading from the Royal Canin facility.      Photographer: Dave Michaelson



Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
 Subject: Randy Sarver, MDNR-ESP, collecting dissolved oxygen readings at the intersection of the unnamed tributary and the ditch leading from the Royal Canin facility.      Photographer: Dave Michaelson





Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
Subject: Photo showing sheen on the surface water of the unnamed tributary downstream  
of waterway leading from Royal Canin facility.      Photographer: Dave Michaelson



Date: April 8, 2005      Location: Archie Spencer Property; Phelps County, MO  
Subject: Accumulation of fatty material in backwater area of unnamed tributary  
downstream from waterway leading from the Royal Canin facility.  
Photographer: Dave Michaelson

## **Appendix C**

Macroinvertebrate Bench Sheets  
(-99 = Present as Large/Rare)



**Aquatic Invertebrate Database Bench Sheet Report**

April 8, 2005 - Trib. Little Beaver Ck [0503067], Station #1

<b>ORDER (Taxa)</b>	<b>CS</b>
<b>"HYDRACARINA"</b>	
Acarina	2
<b>ARHYNCHOBELLELLIDA</b>	
Erpobdellidae	-99
<b>COLEOPTERA</b>	
Dytiscus	3
Hydroporus	5
Ectopria nervosa	1
Stenelmis	3
<b>DECAPODA</b>	
Orconectes luteus	-99
<b>DIPTERA</b>	
Ceratopogoninae	3
Ablabesmyia	2
Nilotanytus	14
Corynoneura	7
Cricotopus/Orthocladius	146
Eukiefferiella brevicarica grp	12
Eukiefferiella pseudomontana grp	2
Orthocladius (Euorthocladius)	1
Parametriocnemus	4
Rheocricotopus	10
Thienemanniella	1
Tvetenia bavarica grp	5
Dicrotendipes	1
Polypedilum convictum grp	26
Polypedilum illinoense grp	1
Micropsectra	5
Stempellinella	1
Tanytarsus	7
Clinocera	5
Thienemannimyia grp.	14
Diptera	3
<b>EPHEMEROPTERA</b>	
Ameletus lineatus	3
Acentrella	29
Dipheter	6
Heptageniidae	3
Stenonema femoratum	3
Caenis latipennis	10
Paraleptophlebia	62
<b>LIMNOPHILA</b>	
Physella	-99
<b>PLECOPTERA</b>	
Leuctra	9
Amphinemura	110
Perlesta	48
Isoperla	23
<b>TRICHOPTERA</b>	
Ceratomyza	1
Rhyacophila	10
<b>TRICLADIDA</b>	
Planariidae	33
<b>TUBIFICIDA</b>	
Tubificidae	1

**Aquatic Invertebrate Database Bench Sheet Report**

April 8, 2005 - Trib. Little Beaver Ck [0503066], Station #2

**ORDER (Taxa)****CS****ARHYNCHOBDELLIDA**

Erpobdellidae 2

**COLEOPTERA**

Dytiscidae 1

Hydroporus 5

Ectopria nervosa 10

Stenelmis 24

**DIPTERA**

Tipula 1

Ceratopogoninae 2

Simulium 4

Nilotanypus 56

Cricotopus bicinctus 2

Corynoneura 12

Cricotopus/Orthocladius 129

Eukiefferiella brevicar grp 10

Eukiefferiella pseudomontana grp 2

Orthocladius (Euorthocladius) 1

Parametriocnemus 5

Rheocricotopus 7

Thienemanniella 3

Tvetenia bavarica grp 15

Paratendipes 1

Polypedilum convictum grp 17

Polypedilum illinoense grp 3

Pseudochironomus 1

Micropsectra 4

Paratanytarsus 1

Tanytarsus 24

Clinocera 3

Thienemannimyia grp. 17

**EPHEMEROPTERA**

Acentrella 13

Diphetor 5

Stenonema femoratum 12

Caenis latipennis 36

Paraleptophlebia 39

**ODONATA**

Libellulidae 1

**PLECOPTERA**

Leuctra 36

Amphinemura 26

Perlesta 109

Isoperla 18

**TRICHOPTERA**

Polycentropus 2

Rhyacophila 3

Ochrotrichia 2

Helicopsyche 9

**TRICLADIDA**

Planariidae 4

**TUBIFICIDA**

Tubificidae 2

Limnodrilus hoffmeisteri 3

Enchytraeidae 1